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Features
October 2003

Detection and recognition invention aids target recognition for military pilots

by Sarah Hubbard, Sensors Directorate

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — The Automatic Target Recognition Team from the Air Force Research Laboratory's Sensors Directorate has invented a detection and recognition process that matches potential battlefield targets to known targets in Air Force databases.

Their detection and recognition Process measures the similarity of a battlefield picture or radar image to a database file of a target and bypasses all forms of template matching.

The main goal of this process is to achieve Automatic Target Recognition and Combat Identification (CID). CID is the process of attaining an accurate characterization of detected objects in the joint battlespace to the extent that high confidence, timely application of military options and weapons resources can occur, said Dr. Gregory Arnold, ATR Team member at the tracking and fusion branch of the AFRL Sensors Directorate. A computer will watch all the output of video cameras, radars and other Air Force sensors, aiding the pilot or intelligence analyst by letting them concentrate on the task at hand.

The Automatic Target Recognition, or ATR Team does not build the cameras involved in the sensor hardware design; they try to make the cameras smarter and more useful by outputting regions of interest and targets of interest along with the raw data, Arnold said.

"Our research is attempting to answer the fundamental questions of how to do ATR right," Arnold said. "To date, there had been no fundamental theory for how to construct an ATR algorithm, which is a mathematical rule or procedure for solving a problem. There had been no theory for rejecting unknown targets reliably or for efficiently searching a database."

The ATR Team built such a theory by understanding the fundamental relation between objects and images and constructing a metric, or measurement, for comparing objects to images.

Object- Image Relations (OIRs), indicate when an object and image are consistent. OIRs help to answer questions about what objects could have produced a given image, said Dr. Vincent Velten, another ATR Team member who worked on the project.

An Object-Image Metric indicates how to measure the distance between images, the distance between objects, and the distance between an object and an image.

"We believe the metric will affect both the overall ATR algorithm approach as well as the implementation of many components of the algorithm," Arnold said.

Current algorithms have limited abilities so they cannot help with many of these tasks. These systems are largely based on pattern recognition techniques, which have serious limitations. Their approaches require a very large database of pictures and objects that must be created, maintained and searched sequentially for potential matches, Arnold said.

The new process avoids item-by-item searches through huge databases in order to find a match, which will save a great deal of online computation time, Velten said. It will hold the same amount of information as the original database, but it will be dramatically smaller. @